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Without the Aid of the Heart.

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The Main Power for the Circulation of the Blood Received through the Lungs from the Air Breathed.

The Most Valuable Discoverg in Centuries for the Benefit of Humanity.

The Key to Health and the Mysteries Regarding the Cause of Internal Diseases.

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POSITIVE PROOFS THAT THE BLOOD CAN CIRCULATE WITHOUT THE AID OF THE HEART.*

The Main Power for the Circulation of the Blood is Received Through the Lungs from the Air Breathed.

In an address delivered at the National Convention held at Omaha last June (1898), I claimed to be the first physician to discover the law and power that propels the blood throughout the system, and that this power was furnished to the blood by the lungs, the air breathed containing the oxygen which charges the blood-cells with circulatory power, thus overthrowing the old theory that the heart is a pump, and by the pumping process the blood is propelled throughout the body, as has been held by physiologists ever since Harvey discovered that the blood circulates.

To oppose a doctrine that has been one of the main pillars of physiology, one which has been advocated and promulgated by illustrious men for centuries past, may seem to be presumptuous, and theories

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so advanced have always been, as medical history will show, also met by strong opposition, until the question of the fact involved has been positively and conclusively demonstrated. Such was the case when Harvey taught that the blood circulates in the body.

The object of this paper is to show positively by experiments made upon the living animal. First, that the blood can circulate without the aid of the heart. Second, that the arteries (as now taught) are no aid in assisting blood circulation, by muscular contraction; further, that the main function of the heart is to regulate, and that it is a distributing center and agitator for the blood.

The strongest point made in my former thesis was concerning prenatal circulation, in which I endeavored to show that the heart could not be the cause, neither could it have the power necessary with which to propel the blood. No one can study the great uterine placental and foetal circulation without coming to the conclusion that something besides the mechanical power of the heart is the force which accomplishes this wonderful feat of nature.

I also endeavored to show that this, with the many other observations to which attention was called, ought to have some merit, in proving that the heart cannot be the main power that propels the blood, and if so, I thought they would perhaps stimulate some one with more leisure and wealth than I, by actual experiments and demonstrations to positively prove

or disprove my observations and reflections, and if proven, to this add a very important discovery to physiology.

I think it is of much importance to pay attention to the visible facts, and if there are any hypothetical difficulties with the existing phenomena, it is better to reconcile them with the existing phenomena, instead of explaining the phenomena to suit the difficulties. It cannot be denied that the molar or visible manifestations of physical laws are only the expression of the atomic and molecular actions. The atomic and molecular are very properly considered by themselves, even if regarded as matters of uncertainty, but they ought not to outweigh the direct testimony of experiment and visible phenomena.

The following pages will contain the results obtained by experiments made upon forty or fifty living animals of various kinds, such as the dog, hog, chicken, turkey, cat and steer. This was sufficient to again and again verify each point.

The full grown hog, not too fat, has proven to be one of the best animals for experimental purposes, because its inner organs compare nearer to man's than any other animal, and because their endurance under chloroform or ether for a long time without the apparent nervous shock which other animals manifest, is much greater.

The first experiment was made upon a hog weighing from two hundred and fifty to three hundred

pounds. After administering an anesthetic the abdominal cavity was opened, the aorta and the continuous arteries and accompanying vein were laid bare along their whole length to the end of the foot, making nearly four feet of blood-vessel laid bare in one continuous length. The hog was then suspended by its hind legs; and the aorta was tied close to its emergence from the diaphragm. In less time than it takes to tell it the entire blood-vessel (four feet straight upwards) with all the accompanying branches was empty, while the veins increased in their fullness. The aorta was then untied and the blood was again permitted to circulate, and when it had found its equilibrium, both the large artery (aorta) and vein were ligated at their emergance from the diaphragm, this absolutely cutting off the circulation from any influence from the heart—the arteries all emptying themselves of their blood just as readily as when the artery alone was tied, the only difference being that the veins of the lower portion of the body became more full. This experiment alone demonstrates beyond question the fallacy of the old teaching.

The next step was to remove the stomach and intestines and repeat the two experiments, just cited, with the same results. These astonishing as well as gratifying results were a stimulant for further and more thorough investigations. The animal was then taken down and laid upon the

table, the aorta ligated at the diaphragm, and all its branches between this point and its bifurcation were also tied. It was then ligated at its bifurcation, when the blood-vessels emptied themselves beyond this point. The ligature at the bifurcation was then removed and again the remaining blood between the mentioned space started alone, although not as rapidly as at the first.

But let us not be content with this overwhelming evidence, but go a little farther and make our way into the chest cavity; but before doing this, I want to call attention to a point so much harped upon by our physiologists — I mean muscular contraction of the blood-vessels as an aid to the circulation of the blood. To refute this hypothesis I will state that the aorta from the heart nearly up to the illiac bifurcation is as firm, non-contractile and solid in a full grown hog as a rubber lawn hose, so much so that it can be drawn together with difficulty with a ligature. The aorta in all animals is white and of a fibrinous character.

In the steer, the aorta at its large end is a quarter of an inch thick, a solid tube, and remains in all large animals in this firm condition when empty; but when we watch the passing of the blood through arteries in the small vessels, we see a waving motion of the blood which has probably been construed into contraction of coats of the artery. A similar waving motion can

be felt in a rubber tube with a narrow nozzle at one end of the tube attached to a forcible hydrant.

The little transverse elasticity of the smaller arteries therefore has no influence upon the circulation of the blood, but only gives space for the various changes of blood pressure that must of necessity occur very often under the many different conditions produced from differences in respirations, excitements, brain or muscular activity and many other emotions that the human being is subject to while awake or asleep.

In a concise manner I have considered the various experiments and observations outside of the chest cavity. But in entering the cavity that contains the heart and lungs, we meet with many difficulties. First—an opening in the chest immediate collapse of the lungs is produced by the external air pressure, which consequently cuts off the breathing, which means the death of the animal in a few minutes. To overcome this difficulty, to me at least, at first seemed impossible, but after a number of unsuccessful attempts, a plan was devised by which an animal could be kept breathing for two or more hours without much difficulty. No one can watch the action of the heart, lungs and circulation in a large animal without marvel and astonishment.

As all the breathing of the animal now has to be entirely kept up by artificial means, the lungs can be allowed to collapse or be inflated at will—almost any kind of experiment can be made—first, by allowing

the lungs to collapse we see the arteries emptying themselves of the blood, and the veins, with the accompanying auricle and ventricle of the heart becoming distended, but the action of the heart goes on as usual only slower, and gradually with less vigour, and to all appearances the animal is lifeless, except, that the heart keeps up its motion (which it would do for a long time if cut out and laid on a plate). Now if breathing is begun (artificial) one of the first things noticed is that the heart arouses itself to vigorous action. The lungs begin taking up the venous blood making its circuit through the lungs back to the heart, and as the heart begins to distribute it, the arteries begin to fill and soon life manifests itself throughout the body.

The above experiment suggests a volume of philosophy. I have demonstrated it on many animals of various kinds, and it accords so well with the ideas of men who find that force acting upon matter bestows life and motion upon matter. Call this force what you will—call it electricity, call it oxygen or ozone, it is this element of so-called force without which all matter is lifeless, and without any power to move or alter itself. The fact is that force brings about all changes in matter that our senses tell us of, which of course, includes the material human body.

It is this force that causes all the changes, matter remaining ever the same. And it is evident that did not unbound forces continully influence our bodies

we would have no life, for these bring about the change of matter within us, which is necessary to life —the bound forces only maintaining the structure of the body. These alone cannot cause motiou any more than the particles of matter alone can adhere to one another. For matter has no binding power, this is due to the forces that are inseparable from it. Then these bound forces must be the cause of the solidity of the body. And by this law of recombination and differentiation, I predict that the causes of all diseases will be ultimately explained.

In the pulmonary veins, there is no pulsation as is found in the rest of the arterial system, but in puncturing the pulmonary vein the blood will spurt out with a force nearly equal to that of the arteries.

Another point that demonstrates positively that the heart is not the real propelling power of the blood, is the fact known to the ancients, that after death the arteries are empty; it was from this phenomena that the belief arose that the arteries contained no blood, but air; hence the name artery (which means air-pipe). Now if the heart were a pump it would be impossible for the arteries to be empty after death, for when a pump ceases to do its work, the fluid pumped would cease to flow, consequently, the blood would remain in the arterial system

Galen thought that the object of breathing was to take into the lungs what is termed pneuma or spirits. That air breathed underwent in the lung tissue a change

which resulted in the production of vital spirits. The spirits according to Galen, was not the substance of atmospheric air, but something produced from it by the transforming agency of the lung. If Galen could have known what is now known of Chemistry, he would have readily exchanged the word spirits for Oxygen—he would have likely demonstrated the power of the circulation of the blood eighteen hundred years ago of which we so far have been in the dark. He says further, the lungs by breathing take up an unknown gaseous substance essential to life. Had this great ancient writer substituted the word oxygen for his spirits, his comprehension of physiology would have been ahead of ours at the present time, especially about the circulation of the blood.

Again Galen says that the mechanical force of the heart was not the only one by which the animal fluids were drawn or impelled in the needful direction. He thought there was a physiological force which he compared with that of a magnet, by which the tissue attracted the ingredients for its nourishment, as we would express it to-day, that the electrical power has something to do with the circulation.

If an animal is killed and the chest and the abdomen opened immediately, the arteries will be found empty, whether this animal was suddenly killed by a blow or killed by chloroform—the result will be the same. In other words, as soon as the lungs collapse, the cycle of circulation is cut off, the arteries empty-

ing into the veins, which become very much distended. But if a large bullock or any animal is knocked down and stunned, the arteries of the neck being cut, leaving the veins intact, the body will empty itself of the blood through these cut arteries—all due to the breathing of the animal during this process, but if the animal is stunned sufficiently to arrest breathing the blood will remain in the veins. These are well known facts to butchers, and it ought to seem to any one that if the blood did not have the power to travel without the assistance of the heart it would be impossible to bleed an animal thoroughly enough to render its flesh proper food for mankind.

The more active the breathing of the animal the more quickly is the body drained of blood. If an animal is obliged to breathe impure air, or to reinhale previously breathed air, upon opening the chest it is found that the arterial blood is not of a bright red color, but has more of the appearance of venous blood. Then if strong artificial respiration is kept up giving strong action to the heart, by pucturing or cutting an artery we do not obtain that amount of force and the steady stream of blood as we do when the blood is well oxygenized, in fact, the stream will often not be one-fourth that of normal arterial blood, and if under this condition the blood vessels are ligated in the manner already described, the arteries will empty themselves slowly and often much blood will remain in the arteries, where if the blood is oxygenized by pure

air, the arteries under the same condition will empty in less time than it takes to write it.

This particular phenomenon I think the most important of all when considered in the light of health and disease, its result upon the nutrition of the body and the action of such blood upon the chyle, and and the inactivity of such circulation upon carrying off the necessary waste products, debilitating all systemic functions, so that the same food eaten to-day, making us happy, as well as giving good nourishment to the body, to-morrow, the same food when taken without sufficient quantity and quality of oxygen in the air breathed, would produce results all the way from a dull feeling to some severe form of disease. Poor food and good air will do so the same, but not so readily.

THE LUNGS AND HEART.

The functions of the lungs and heart afford the most striking evidences of Nature's skill and beautiful illustrations of her handiwork. One strong feature can be noticed when watching the lungs and heart under experiment for hours—that the heart so to speak—"dances to the music of the lungs." This means that when the lungs are taking in pure air, and the blood normal, just as an engine responds to the steam from the boiler.

The heart has an especially important function to perform in its regulating powers to keep up an equi-

librum of the blood, and to accomplish this it needs nearly all the power that an organ of its size could well possess. We all know the extreme pressure often exerted upon the heart under severe excitements and emotion. Another point is always certain that whenever breathing is aroused, the heart action is also increased. We also know that nervous influences have a similar affect upon the heart. The muscular activity of the heart or its contractions are a very necessary function to distribute and start the blood in its various channels, to brain, arms, lower extremities and the different organs of the body, but besides this, the heart has more of a whirling or churning action than direct contractile motion.

As already stated that the difference noticed in the action of the blood in the pulmonary veins and arteries, that the heart in its churning and contractile action agitates the blood, so as to give increased molecular activity to the charged blood-cells, and thereby give increased activity to the blood to circu late alone throughout the system. This accords well with the difference noticed when puncturing a large artery—the blood spurts out like a fluid that had been agitated, while puncturing the pulmonary vein, such phenomena is not noticed.

H. P. Pratt, M. D., professor of Electric Thereapeutics of Chicago, called my attention to this point of agitation after reading my first paper, and as stated, I

believe from the phenomena manifested it has much merit.

I have tried in many experiments to discover how the blood circuit is made in the lungs, but at present can only describe what is visible to the eye. When the lung is inflated with air, by cutting off a third of the lobe we find two vessels side by side and of an equal size—one an air-tube, out of the other a stream of dark venous blood flows, and the balance of the lung or lung cells present a bright red appearance.